

## **Quality Systems in the Cement Industry according to ISO Standards**

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Formalized and documented quality systems are increasingly applied in the cement industry, often applying the models given in the ISO 9000 standard series. The article addresses the internal and external reasons for this trend and outlines the basic features of ISO 9000 and the criteria for an appropriate documentation. Examples of application and documentation's from 'Holderbank'. Group plants are discussed.

## **1. INTRODUCTION**

The cement industry has been traditionally subjected to an extensive product standardization. The compliance with these standards formed the only generally valid quality liability towards the consumer. The way in which the products are produced and in which the quality is controlled has been entirely up to the producer.

In many other industries, another method of quality commitment in the supplier/customer relationship has been adopted: in place of product standardisation - which is practically impossible for products undergoing rapid developments - the manufacturer has to provide evidence that he disposes of a quality system that enables him to plan and realize a state-of-the-art quality level throughout the production cycle of the product. Efforts to find an internationally agreed upon concept of quality systems and a generally accepted terminology eventually resulted in the ISO 9000 standard series which were approved in 1987, and which were adopted in many national standards as well as in the European standards (EN 29 000). It is a fact that today many of the supplier/ customer relationship in Europe are based on these standards.

## **2. REASONS FOR IMPLEMENTATION OF DOCUMENTED QUALITY SYSTEMS**

Various reasons taken individually or in combination, can lead a company to implement a quality system along with a corresponding documentation.

### **2.1 Internal reason**

#### **2.1.1 Confidence, transparency efficiency.**

A well documented quality system provides transparency and confidence with regard to all quality related activities, both to those directly involved in production, marketing, and quality assurance, and to the company management

### **2.2 External reasons**

#### **2.2.1 Market.**

Customers can require the existence of a (certified) quality system as a prerequisite for a delivery contract. This particularly applies for large customers or for customers in the public sector.

#### **2.2.2 Product liability**

For the protection of the individual private consumer, fault independent regulations for damages caused by defective products are increasingly being introduced. While such consumer oriented product liability legislation has been established in the USA for quite some time, similar laws have been, or are being introduced in Europe following the guidelines issued by the EC - Commission - as well as in other parts of the world.

A documented quality system and the availability of quality data records can be considered as effective preventive measures for avoiding the release of defective products and are moreover valuable evidence for the defence of a producer in case he is involved in a product liability litigation.

### 2.2.3 Certification of products conforming to standards.

There is a trend largely promoted by consumer-oriented organisations - that the conformance to standards of a given product should be certified by official authorities (certification body, approved body). The scheme for certification may not only involve external product control, but also the requirement of a documented quality system. This aspect may become the <<driving force>> for implementation of standard quality systems based on national or international standards (e.g. ISO 9000) in the European cement industry, as further outlined in the subsequent chapter.

## **3. IMPLEMENTATION OF DOCUMENTED QUALITY SYSTEMS IN THE CEMENT INDUSTRY**

### **3.1 General**

Until recently, there was little external pressure for establishing documented quality systems in the cement industry. Nevertheless, a number of plants have established a company-wide quality system and documentation on a volunteer basis, with a view to improve internal transparency and efficiency and/or to use it for promotional purposes to gain a competitive advantage.

Increasingly, however, external factors are pushing the cement industry, at least in certain regions, to adopt documented quality systems, practically exclusively according to ISO 9002:

The British Cement Industry has subjected itself to a certification scheme by the British Standard Institute (BST). Labels for <<quality assured cement>> are granted to the products of cement manufacturers certified on the basis of a ISO 9002 quality system.

In Australia, the cement and construction industries are subject to the generally valid state regulation that <<all firms supplying manufactured goods to (governmental) agencies, must have adequate quality assurance systems...>>. In practice, again, the ISO 9002 system is adopted.

Very recently (1991), API—the American Petroleum Institute—has introduced the demand for a documented quality system (Q1) similar—though not identical—to ISO 9002 for granting their monogram on well cement.

### **3.2 Specific European Situation**

In the context of the European cement standardization, (EN 196; ENV 197) a scheme for the certification of conformity of cement complying with the requirements of ENV 197 has been proposed (document entitled <<European Cement Certification>>). The proposed scheme takes account of, and refers to two EC regulations, namely the Construction Products Directive" and the <<Global Approach to Certification and Testing>>, which attempt to harmonize within Europe the regulations, the standards and the means for verifying compliance with standards.

The European Cement Certification scheme defines the tasks of the manufacturer and of approved bodies, in order to obtain product certification. Among the tasks of the manufacturer belongs the implementation of a quality system based on EN 29002 (ISO 9002), to be documented in form of a quality manual. It is foreseen in the scheme, that approved inspection bodies regularly inspect the production facilities, quality control procedures and testing equipment with a view to approve and verify the procedures defined in the quality manual. This implies a considerable intensification of external control for assuring conformity to standards, which has so far been largely based on auto-control and external control of finished products. It has to be pointed out that this certification scheme is still much debated and an approval in the majority of the member countries not yet in sight.

It is noteworthy that Spain has adopted in form of national standards, not only the draft EN cement specifications (ENV 197), but also a certification scheme largely identical to the proposed <<European Certification Scheme>>.

#### **4. PRINCIPLES OF THE ISO 9000 QUALITY SYSTEM**

The ISO standard series 9000 on quality systems has become effective in 1987. It describes models and elements for quality systems in different contractual situations and for the internal quality management.

ISO 9000:	Quality management and quality assurance standards—Guidelines for selection and use.
ISO 9001:	Quality systems—Model for quality assurance in design, development, production, installation and servicing
ISO 9002:	Quality systems—Model for quality assurance in production and installation
ISO 9003:	Quality systems—Model for quality assurance in final inspection and test.
ISO 9004	Quality management and quality system elements—guidelines

For the purposes of the cement industry, the ISO 9002 is usually applicable. The main points of emphasis of these standards can be summarized as follows:

- ◆ Company commitment to quality; quality responsibility on top management level.
- ◆ Clear definition of quality relevant procedures, including organisation and responsibilities, throughout the production process and the various departments involved
- ◆ Clear definitions of measures in case of non-conformity to quality targets
- ◆ Training of personnel
- ◆ Requirement for quality audits
- ◆ Implementation of a continuously updated quality documentation.

The ISO 9001-9003 Standards for quality systems explicitly describe models for quality assurance. Their application has to be made company (or industry) specific.

## 5. ASPECTS OF QUALITY SYSTEM DOCUMENTATION ACCORDING TO ISO 9002

### 5.1 General

A quality system has to be documented in order to make it visible, applicable, and auditable. The ISO 9000 explicitly demand the establishment of a quality system documentation.

It is recommended to apply the <<pyramid structure>> for the organisation of the quality system documentation (Fig. 1). Usually, three document levels are distinguished:

- ◆ Quality Manual
- ◆ Quality Procedures (for Quality Guidelines)
- ◆ Work instruction and test descriptions

**Fig 1 Structure of Quality System Documentation**

Covering	Distribution	Description
Entire enterprise	Internal: Management Head of Departments  External: when required	Quality Manual  Principles, organisation, procedures; Company-wide relations, responsibilities, competences. Contains organisational know-how References to QP, WI, TI
Sections Departments	Internal only: To departments concerned	Quality Procedures (QP)  Detailed description of individual sections of quality system. Contains organisational and technical know-how.
Particular areas Individual activities	Internal only: Working place	Work instructions (WI) Test instructions (TI)  Definition of details, detailed instructions, testing specifications

(Source: SAQ, Leitfaden zur Normenreihe SN-ISO 9000 Bern 1989)

The <<pyramid-structure>> offers the following advantages:

- ◆ The quality manual may be kept relatively short. It provides a transparent guideline to the concepts of the quality system, its organisation and procedures. It provides the connections to the other document levels by referencing.
- ◆ The quality manual largely covers the organisational aspects of the quality system and may thus be made accessible to externals (customers) without disclosing technical know-how.
- ◆ The quality manual is not subject to frequent modifications.
- ◆ On the workshop level, only parts of the quality procedures and works instructions are required, which can be selectively distributed.

When applying the ISO 9000 standards, the structure of the quality manual should, but need not, follow that of the standards, i.e. the list of contents should correspond to that of the corresponding standard. If a different structure is applied, which may be better adapted to the company's requirements, a correlation has to be made with the clauses of the standards.

For the administration of the quality manual and all other quality system documents, it is advisable to

- ◆ use loose sheets to facilitate exchange of pages or chapters
- ◆ indicate date and stage of revision on each page or chapter number the pages only within a chapter
- ◆ to have a control on the internal and external document distribution.

## **6. EXAMPLES OF ISO 9000 QUALITY SYSTEMS IN 'HOLDERBANK' GROUP COMPANIES**

### **6.1 Queensland Cement Ltd. (QCL) Australia**

(see article on page 38, this issue)

### **6.2 Cementos Boyaca (Columbia)**

The implementation of a company-wide quality system at Cementos Boyacà started some four years ago, on an entirely voluntary basis. The reasons were, on one hand, a recognised lack of efficiency and of personnel motivation in most sections of the plant, and on the other hand, the objectives of the Company in the frame of PMI (Project Marketing Innovation) and TOC (Total Offer Concept), necessitating a market and quality orientation of the company. As a definite target and motivating factor to improve the company-wide quality assurance, the attainment of the national quality award <<Premio Nacional de Calidad>> was aimed at. This goal was reached in 1991, when the quality award was granted to Cementos Boyacà. (see 'Holderbank' NEWS 4/91, p.5).

### **6.3 HISALBA**

As already mentioned in chapter 3.2, the Spanish national standard is very close to the proposed <<European Certification Scheme>>. The cement plants of the HISALBA group, therefore, have certified quality systems according to ISO 9002. A comprehensive information on his topic was recently published by HISALBA (Calidad y Automatización HISALBA).

#### **6.4 Groupe Origny (France)**

In the context of the French scheme for approving cement trade marks (AFNOR), all plants of the Origny group have had to dispose of quality manuals (<<plans qualité>>) for many years to give evidence of existing quality systems. The requirements on the manuals have not been very high; the document could be kept very short and had admittedly little significance for the practical day-to-day quality assurance in the plant

Recently, the Groupe Origny took the decision to reelaborate these <<plans qualité>> in such a way that they would become practice relevant, binding working tools. Among others, the following objectives were put forward:

- ◆ Quality improvements of final and intermediate products should be achieved by increased efficiency, at minimum investment costs. Quality deficiencies should, without exceptions, be detected (and eliminated) internally and not by customers.
- ◆ Preparation for the anticipated higher requirements on quality systems and documentation within the future European Certification scheme (ISO 9002).
- ◆ Maintenance of company image and market position in view of similar efforts to implement documented quality systems being made by competitors

With these objectives in mind, Origny made the interesting approach to describe in detail all quality relevant procedures from quarrying to cement dispatch, by applying just two types of formalized sheets. These sheets contain instructions on routine procedures, frequencies of sampling and testing, targets, acceptance and alarm limits, instruction in case of exceeding the limits, etc. and are distributed to all concerned and continually updated in order to strictly conform with actual practice at all times. About 90 sheets were required to cover the entire process of the Origny plant.

Origny intends to incorporate the entity of these sheets in the future quality documentation as required by ISO 9002.

#### **6.5 Conclusions**

From the yet limited experience within the 'Holderbank. Group'—and the cement industry in general—it is an undisputed fact that the implementation and documentation of a quality system according to ISO 9002 is an immense task. It has also become evident that an implementation can only be successful (and durable) with the uncompromising support of the company management.

The opinions regarding the benefit of such a system are still divided. The main criticism expressed by the sceptics is that the written procedures are, in the best case, declared intentions, over-emphasising in their very nature the quality aspects of cement manufacturing. In practice, it is claimed, pragmatic considerations of other production or cost related aspects at a given situation and point in time, may result in decisions not congruent to the instructions contained in the quality documentation. Furthermore, it is pointed out that it is questionable whether the considerable effort will always be made to update the system and the documentation in the course of changes arising in the process, in the materials used, and in the organisation of the company.

On the other hand, the astonishingly good acceptance in companies where such systems have been introduced, is quite remarkable. The benefits often put forward better organisation, clarified responsibilities, well defined decision criteria etc. resulting in better plant operation, improvements of intermediate and final product quality and hence in strengthened market position—indicate that significant weak-points in these respects exist in many companies. It thus appears that the detailed scrutinizing of all activities and procedures which is mandatory for establishing a documented quality system, is by itself already very valuable, as many deficiencies can already be detected and rectified at this stage. Attention is also drawn to todays more rapid fluctuations in personnel in the context of which well-documented procedures and instructions serve as most valuable training tools.

The experience is not yet sufficient to permit definite conclusions on the above argument. The present trend, however, is in the direction of increased application of ISO 9002 standards as a consequence of market or standard requirements. It is therefore advisable that the companies closely follow the developments and start their preparation in time. In a situation where the implementation of a complete ISO 9002 quality systems is not yet very urgent, a stepwise elaboration starting on the work instruction level is a recommendable practical approach, as it was carried out by Origny. The ultimate application of a complete ISO 9002 quality system will, in many cases, not be a question of choice but of survival.

